FINAL PROGRESS REPORT
Contract No. NASW-00023
PI: Stefanie Tompkins

Summary of Work Accomplished:

Work accomplished on contract NASW-00023 between 20 April 2000 and 19 April 2001 is described below. Key abstracts are attached.:

Project 1: Detailed Crustal Stratigraphy from Central Peaks Measurements

- Comparison of Lunar Prospector gamma ray spectrometer data to Clementine results at Tycho continues.
- Presentation and discussion at Workshop on New Views of the Moon III [*Tompkins*, 2000]
- Compilation and writing of crater work for proposed book on New Views of the Moon has begun.
- Analysis continues for combined interferometric SAR-derived digital elevation data and Clementine multispectral data at Tycho [*Tompkins*, 2000].
- Tycho analyses continue with B. Ray Hawke; abstract submitted to Lunar and Planetary Science Conference [*Tompkins and Hawke*, 2001; *Tompkins et al.*, 2000].
- Work on convolving high-resolution telescopic spectra with multispectral images (Clementine UVVIS camera data) begun at crater Copernicus with J. M. Sunshine [*Sunshine and Tompkins*, 2001].

Project 2: Remote Sensing Applications of Lunar Impact Melt Spectra

- A draft manuscript for the *Journal of Geophysical Research* has been prepared and is currently in review by my co-authors to report both the laboratory measurements and implications for remote identification of impact melts [*Tompkins et al.*, 1999]. The delay is due to a missing data table that a co-author would like to add to the paper, but has not yet prepared.

Analysis Summary:

The main direction of research as proposed concerned determining crustal composition through the examination of impact crater central peaks. This year of research continued more focused, localized studies of selected craters, beginning with Tycho and Copernicus. The accomplishments with respect to this work include:

(1) Research into the effects of topography on the derivation of geochemical and mineralogical estimates from multispectral data. Tycho incidence angles were derived from both digital elevation models and spectral mixture models (in which a shade component serves as a proxy for the incidence angle). The data were then corrected for topographic effects, and FeO abundances were calculated from the corrected data. Initial results indicate large over- or underpredictions of FeO within Tycho [*Tompkins and Hawke*, 2001].

(2) Out understanding of Tycho's composition has been found to be affected by Tycho's extreme immaturity. The crater's relatively high albedo is causing FeO estimates based on Clementine data that are at odds with estimates based on Lunar Prospector gamma-ray estimates. The differences – and their causes – need to be resolved, and extended to other lunar craters [*Tompkins and Hawke*, 2001].

(3) The crater Copernicus was used as a test case for a new approach to combining high spatial resolution multispectral images with high spectral resolution point spectrometer data, to increase

the apparent spectral information for an overall scene. Initial results are extremely promising, and were presented at this year's LPSC [*Sunshine and Tompkins*, 2001].

(4) Global crater maps derived under previous research funds have been used to test geophysical models of crustal thickness [*Wieczorek and Zuber*, 2001], and appear to support a dual-layer lunar crust. Craters in areas that are inconsistent with the model predictions are being examined in more detail, to provide better constraints to the geophysical modeling.

References:

Sunshine, J.M., and S. Tompkins, Yet another look at Copernicus: Projecting telescopic spectra onto Clementine multispectral images through spectral mixture analysis (abstract), *Lunar and Planetary Science Conference XXXII*, 2001.

Tompkins, S., The lunar crust beneath the megaregolith (abstract), in *Workshop on New Views of the Moon III: Synthesis of Sample Analysis, On-surface Investigation, and Remote Sensing Information*, Houston, TX, 2000.

Tompkins, S., and B.R. Hawke, Distribution of materials at Tycho Crater (abstract), *Lunar and Planetary Science XXXII*, 2001.

Tompkins, S., J.-L. Margot, and C.M. Pieters, Effects of topography on interpreting the composition of materials at the crater Tycho (abstract), *Lunar and Planetary Science Conference XXXI*, 2000.

Tompkins, S., C.M. Pieters, and G. Ryder, Remote Sensing of Lunar Impact Melts, *Journal of Geophysical Research, in preparation*, 1999.

Wieczorek, M.A., and M.T. Zuber, The composition of the lunar crust as inferred from central peaks and geophysical crustal thickness modeling, *Geophysical Research Letters, in press*, 2001.

REPORT DOCUMENTATION PAGE

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13. ABSTRACT *(Maximum 200 words)*

This report documents progress with repect to: 1) Determining detailed lunar crust stratigraphy from impact craters, and 2) remote sensing applications of lunar impact melt spectra.

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